

- 1       1. A microcontroller chip, comprising:  
2            a processor for executing program instructions;  
3            an array of configurable circuit blocks configured to perform a circuit  
4            function, such circuit blocks configured to produce an analog output signal; and  
5            an on-chip analog amplifier having an input receiving the analog output  
6            signal and producing an amplified output signal suitable for driving a loudspeaker  
7            external to the microcontroller chip.
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- 9       2. The apparatus according to claim 1, wherein the microcontroller chip has  
10      four corners, and wherein the on-chip analog amplifier is situated adjacent one of  
11      the four corners.
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- 13     3. The apparatus according to claim 1, further comprising a switchable current  
14      source for selectively providing an increase in bias current to the on-chip analog  
15      amplifier under control of the processor.
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- 17     4. The apparatus according to claim 1, wherein the on-chip analog amplifier  
18      comprises a tristatable CMOS analog amplifier.
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- 20     5. The apparatus according to claim 4, wherein the CMOS analog amplifier  
21      comprises a tristate CMOS analog amplifier.
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- 23     6. The apparatus according to claim 5, wherein a tristate mode of the tristate  
24      CMOS analog amplifier is selectively controlled by the processor.
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- 26     7. The apparatus according to claim 1, wherein the on-chip analog amplifier  
27      produces an amplified output signal suitable for driving a 32 ohm loudspeaker  
28      external to the microcontroller chip.
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1       8. The apparatus according to claim 1, wherein the array of configurable circuit  
2       blocks comprise an array of analog circuit blocks and an array of digital circuit  
3       blocks.

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5       9. The apparatus according to claim 8, further comprising a wirebond pad, and  
6       wherein the amplified output signal is directed to an external loudspeaker via the  
7       wirebond pad.

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9       10. The apparatus according to claim 9, further comprising switching means  
10      coupled to the wirebonding pad that selectively disables a connection between the  
11      configurable circuit blocks and the wirebond pad under processor control.

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- 1        11. A microcontroller chip, comprising:  
2              a processor for executing program instructions;  
3              an array of configurable digital circuit blocks configured to perform a digital  
4              circuit function;  
5              an array of configurable analog circuit blocks configured to perform an  
6              analog circuit function, such analog circuit blocks configured to produce an analog  
7              output signal; and  
8              an on-chip CMOS analog amplifier having an input receiving the analog  
9              output signal and producing an amplified output signal suitable for driving a  
10             loudspeaker external to the microcontroller chip.
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- 12        12. The apparatus according to claim 11, wherein the microcontroller chip has  
13              four corners, and wherein the on-chip analog amplifier is situated adjacent one of  
14              the four corners.
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- 16        13. The apparatus according to claim 11, further comprising a switchable current  
17              source for selectively providing an increase in bias current to the on-chip analog  
18              amplifier under control of the processor.
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- 20        14. The apparatus according to claim 11, wherein the on-chip analog amplifier  
21              comprises a CMOS analog amplifier.
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- 23        15. The apparatus according to claim 14, wherein a tristate mode of the tristate  
24              CMOS analog amplifier is selectively controlled by the processor.
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- 26        16. The apparatus according to claim 11, wherein the on-chip analog amplifier  
27              produces an amplified output signal suitable for driving a 32 ohm loudspeaker  
28              external to the microcontroller chip.
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1       17. The apparatus according to claim 11, further comprising a wirebond pad,  
2       and wherein the amplified output signal is directed to an external loudspeaker via  
3       the wirebond pad; and further comprising switching means coupled to the  
4       wirebonding pad that selectively disables a connection between the configurable  
5       analog and digital circuit blocks and the wirebond pad under processor control.  
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- 1        18. A microcontroller chip, comprising:  
2              a processor for executing program instructions;  
3              an array of configurable digital circuit blocks configured to perform a digital  
4              circuit function;  
5              an array of configurable analog circuit blocks configured to perform an  
6              analog circuit function, such analog circuit blocks configured to produce an analog  
7              output signal;  
8              an on-chip tristateable CMOS analog amplifier having an input receiving the  
9              analog output signal and producing an amplified output signal suitable for driving  
10             a loudspeaker external to the microcontroller chip, wherein a tristate mode of the  
11             tristate CMOS analog amplifier is selectively controlled by the processor;  
12             a switchable current source for selectively providing an increase in bias  
13             current to the on-chip analog amplifier under control of the processor;  
14             wherein the microcontroller chip has four corners, and wherein the on-chip  
15             analog amplifier is situated adjacent one of the four corners.  
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17        19. The apparatus according to claim 18, further comprising a wirebond pad,  
18             and wherein the amplified output signal is directed to an external loudspeaker via  
19             the wirebond pad.  
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21        20. The apparatus according to claim 19, further comprising switching means  
22             coupled to the wirebonding pad that selectively disables a connection between the  
23             configurable circuit blocks and the wirebond pad under processor control.  
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